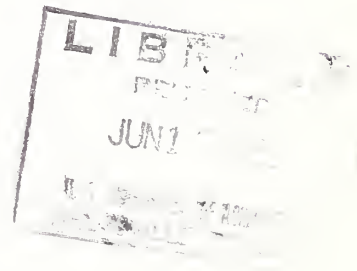


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EFFICIENCY IN POULTRY EVISCKERATION AND INSPECTION OPERATIONS



UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
in cooperation with
The University of Georgia
College of Agriculture Experiment Stations

PREFACE

This report is based on a study made under U.S. Department of Agriculture Contract Number 12-25-010-8768 by American Scientific Corporation, Alexandria, Va.

Persons primarily responsible for conducting the study are John A. Hamann, Investigations Leader, Transportation and Facilities Research Division, Agricultural Research Service, who was the designated representative of the Department; Donald Reed, Industrial Engineer, Westinghouse Corporation, Aero Space Division, formerly with American Scientific Corporation; and Dr. Ray Wenger, Poultry Division, Consumer and Marketing Service, U.S. Department of Agriculture, who worked with ASC personnel to evaluate workmanship during the studies.

Special recognition and appreciation is extended to poultry processing firms on the DelMarVa Peninsula for excellent cooperation in furnishing facilities and making minor adjustments in production levels during time study and testing operations.

The study was conducted under a cooperative agreement between the Agricultural Research Service, U.S. Department of Agriculture, and the Department of Agricultural Engineering, University of Georgia, College of Agriculture Experiment Stations, Athens, Ga.

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EFFICIENCY IN POULTRY EVISCERATION AND INSPECTION OPERATIONS

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BACKGROUND AND OBJECTIVES OF THE STUDY

The purpose of Federal inspection of poultry in processing plants is to assure a wholesome product. It is to the advantage of all people concerned—the producer, the processor, the inspector, and the consumer—that Federal poultry inspection be carried out efficiently and effectively. Good equipment and facilities, properly arranged, and well-trained personnel using efficient work methods are the major requirements for optimum performance of the inspection operation.

Earlier research on broiler processing operations by the U.S. Department of Agriculture covered evisceration operations and equipment. Work methods and their labor requirements were evaluated so that plant managers could measure work performance and do a better job while reducing costs in the eviscerating area.² The re-

search, however, did not include studies of the official USDA inspection operation on the line.

The study reported here was made to determine (1) the time required to perform Federal inspection; (2) the influence of line speed and carcass position, spacing, and conditions on inspection rates; (3) the influence of types of equipment and their condition on inspection efficiency; (4) the validity of eviscerating rates reported in earlier research (see footnote 2), where these were applicable; and (5) the optimum crew (inspection and eviscerating) size and makeup at specified line speeds and types of equipment. The broad objective of this research was to determine the conditions under which evisceration and inspection of chickens can be coordinated most efficiently in a commercial processing plant.

PROCEDURE

Operations were observed in typical processing plants in the DelMarVa area, with different types of eviscerating equipment, processing methods, line speeds, and production levels. These plants were carefully studied to select the most suitable eviscerating lines for the research. Eviscerating lines with production rates ranging between 1,000 and 8,000 birds per hour, requiring one to six in-

spectors per line, were selected for study so as to include all crew possibilities. Eight lines in seven plants were chosen for detailed study.

After selection of the case study plants, the researchers conducted lengthy observations so that they could become acquainted with the equipment, inspection method, eviscerating crew, and inspectors' performances. The extended periods in the plant permitted plant and inspection personnel to become accustomed to the research team's presence so that plant activities were performed under near normal conditions during the studies.

To establish a meaningful relation between time

¹ Stationed at the University of Georgia, Athens, Ga.

² CHILDS, REX E., and WALTERS, ROGER E. METHODS AND EQUIPMENT FOR EVISCERATING CHICKENS. U.S. Dept. Agr. Mktg. Res. Rpt. No. 549, 55 pp., illus. 1962.

values involved in inspection and eviscerating operations and to avoid repeating completed research on the eviscerating operations, the research team did a number of time checks on all eviscerating operations and compared these results with earlier ones. Where discrepancies seemed to exist or where no comparable time values were found in the earlier report (see reference given in footnote 2) for a particular operation, new rates were established through motion-picture time study. The rates used for each operation on the eviscerating line and for Federal inspection are listed in the Appendix.

In each plant, the inspector in charge and the research team observed one or more inspectors. Only those inspectors who seemed least likely to be disturbed by the study and who used the most acceptable hand motions in examining the chicken carcasses were studied. Several test runs, designed

specifically to confirm acceptability of subject choice, were made in each case study plant. The performance of each selected inspector was then filmed several times and a minimum of 10 acceptable work cycles in sequence were timed.

Hand motions of the selected inspectors were evaluated. Although the patterns of the inspectors' hand motions varied to some extent, each inspector followed a relatively uniform method.

Birds inspected during the filming were later reinspected by a supervisory inspector to confirm acceptable workmanship, and the film record was studied carefully to confirm acceptability and completion of each inspection cycle. The resulting values were then analyzed and optimum rates were tested for verification of final recommendations. Film from any unacceptable work cycles was not used for computing inspection time values.

FEDERAL INSPECTION

The function of the Federal inspector on the processing line is to perform a post-mortem examination of each bird as the birds pass the inspection station. The examination requires that the inspector handle each bird physically (fig. 1), involving activities as follows:³

1. The leg bone must be grasped to determine presence of bone disease.
2. The liver must be grasped, palpated, and viewed, and the rest of the viscera viewed.
3. The interior (body cavity) and exterior must be viewed.

³ U.S. DEPARTMENT OF AGRICULTURE. POULTRY INSPECTOR'S HANDBOOK. 144 pp., illus. 1966.



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FIGURE 1.—Post-mortem inspection of poultry on the processing line.

During or following examination the inspector—

1. Releases the bird if it is acceptable.
2. Condemns the bird, and an assistant (the trimmer, a plant employee) records the cause.
3. Causes some portion or portions of the bird, including edible parts, to be trimmed.
4. Causes the bird to be retained for further processing (feather removal, hock trim, removal of contaminated tissue) by plant workers.
5. Retains the bird for further examination by the veterinary inspector in charge.
6. Makes request or recommendations to the inspector in charge or to the management representative relating to the line if this becomes necessary.

The second, third, and fourth of these, and sometimes the fifth, represent an economic loss to the processor (or grower), because of loss of salable product, downgrading of the product, or reprocessing cost.

A composite of inspector methodology may be described as follows: As the birds move past the inspection station from right to left, the inspector grasps the shank of one bird with his right hand and checks for bone leukosis as his left hand releases the cavity and breast of the previous bird. While his left hand is moving into position on the bird being inspected, his right hand is turning the carcass (usually counterclockwise), and he views the exterior for bruises, broken bones, blisters, or lesions of leukosis and other diseases or conditions affecting wholesomeness. His left hand grasps the breast with the forefinger in the cavity, and the bird is tipped toward him slightly as he examines (visually) the body cavity for contamination or disease. Next, he releases the leg and grasps the viscera with his right hand, palpates

the liver between his thumb and forefinger, rolls the viscera, and visually examines it for lesions or disease. The right hand releases the bird (almost simultaneously with the left hand) and moves toward the next bird, completing the inspection cycle.⁴

Trimmers are used to relieve the inspector of duties that are mainly auxiliary to inspection, to provide the inspector more time for decision-making tasks. Trimmers cut off defective or unwholesome parts of carcasses, help check for pin feathers and skin blemishes, place occasional birds on a rack for acceptance or rejection by the inspector in charge, toss condemned carcasses into a can, record causes of condemnations as directed, and perform similar duties requested by the inspector.

FACTORS AFFECTING INSPECTION RATES

Inspection Station Layout

Good arrangement of the work stations for the inspector and his assistant is essential for efficient inspection of poultry (fig. 2). Because of the close working relation between the inspector and trimmer, the inspection and trim station layout is designed as one unit (fig. 3). The inspection and trimming work areas are arranged to complement each other. Arrangements that maximize visibility, minimize the distance the inspector and trimmer must reach, eliminate the need for unnecessary motions, and add to the comfort of inspector and trimmer are essential.

The condition and relative position of each piece of equipment has a bearing, quantitatively and qualitatively, on the inspection operation. Since the inspection cycle is short (about 3 seconds), seemingly insignificant adjustments in equipment arrangement can vary the rate of inspection production by many birds per hour. For instance, reducing or adding a half second to the required inspection time affects the inspection rate by four or five birds per minute.

Since many factors in the inspection station layout can affect the inspection rate, the layout should be arranged so that it does not detract from or interfere with inspection time.

Inspection stations observed in all case study plants were typical and differed only in minor aspects. All provided adequate facilities required to perform a post-mortem inspection.

⁴ When the viscera is suspended to the left, the activities of the left hand are taken over by the right hand or vice versa.

Since there is usually a high noise level in the eviscerating area, a good signal system between inspector and assistant is essential. A combination of voice, hand motion, and carcass positioning is normally used.

Observations made during the study indicated "trim" rates of 17 to 20 percent. These rates included all birds that were subject to some action by the trimmer. Approximately 8 percent of all birds passing the inspector's station (slightly less than half of all trim operations) required a signal from the inspector to the trimmer. These signals were for removal of such things as contamination (generally fecal matter on the carcass), feathers, or bruised legs, thighs or other large areas.

Eviscerating Line Types and Inspection Arrangements

The type of conveyor used on the eviscerating line has a great deal to do with the inspection operation. The three major types of eviscerating line conveyor have been reported in previous research.⁵ They are the single conveyor with divided line, the dual conveyor comprised of two single lines, and the single conveyor with twin shackles that create a double line.

The single conveyor with a divided line has two inspection stations, and the dual conveyor and single conveyor with twin shackles have four or six inspection stations. One other line arrangement not previously studied but discussed in this report is the single-eviscerating line with only one Federal inspector.

The four line and inspection arrangements generally found in poultry eviscerating plants are shown in figure 4.

Type A is a single-eviscerating line with a production capacity that is within the capabilities of one inspector. Birds may be spaced on either 6- or 12-inch centers. This line is seldom used in federally inspected plants, but is discussed here as the low production end of the overall production range covered in this report. When used, it generally served to supplement the production from another type of line.

Type B, the split or divided line, is generally used where the production rate requires the serv-

⁵ CHILDS, REX E., and WALTERS, ROGER E. MONORAIL CONVEYORS USED IN EVISCERATING POULTRY: AN INTERIM REPORT. U.S. Dept. Agr. AMS-290, 15 pp., illus. 1959.



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FIGURE 2.—Inspector (left) and trimmer at inspection and trim stations.

ices of two inspectors. This line, with birds on 6-inch centers, is divided just before the “draw viscera” operation so that alternate birds on 12-inch centers are routed past the inspectors. This split line gives fair to good utilization of both eviscerating labor and the inspectors’ time. It is a common type of line arrangement in some broiler producing areas.

Type C, known as the quad line, is the eviscerating line commonly found in major broiler producing areas. It uses two conveyors (or a single conveyor with dual shackles) over a single eviscerating trough and is served by four inspectors. Good crew balance can be achieved with this line, and it can handle the entire production of a medium-sized plant. Shackles are normally spaced 6 inches apart with inspectors examining birds on alternate shackles.

Type D, the six-inspector line, is identical to type C but has two additional inspection stations. This line is normally used to increase production (up to 40 percent) where plant space is limited. However, production per eviscerating worker is relatively low until total production exceeds line-type C by 1,500 birds per hour. Also, inspector efficiency is considerably less since each inspector examines every third bird, requiring more reach time and more time to position the birds for inspection.

The Human Factor

Individuals who perform Federal inspections are trained to recognize critical wholesomeness factors according to detailed instructions. They acquire skill in observation and manipulation techniques through practice. If all training,

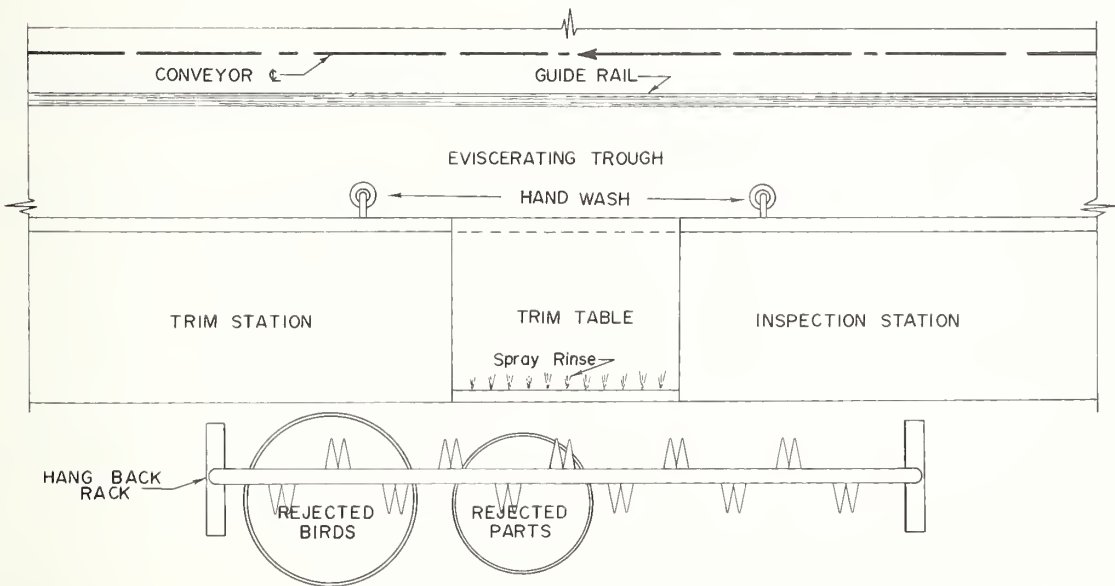
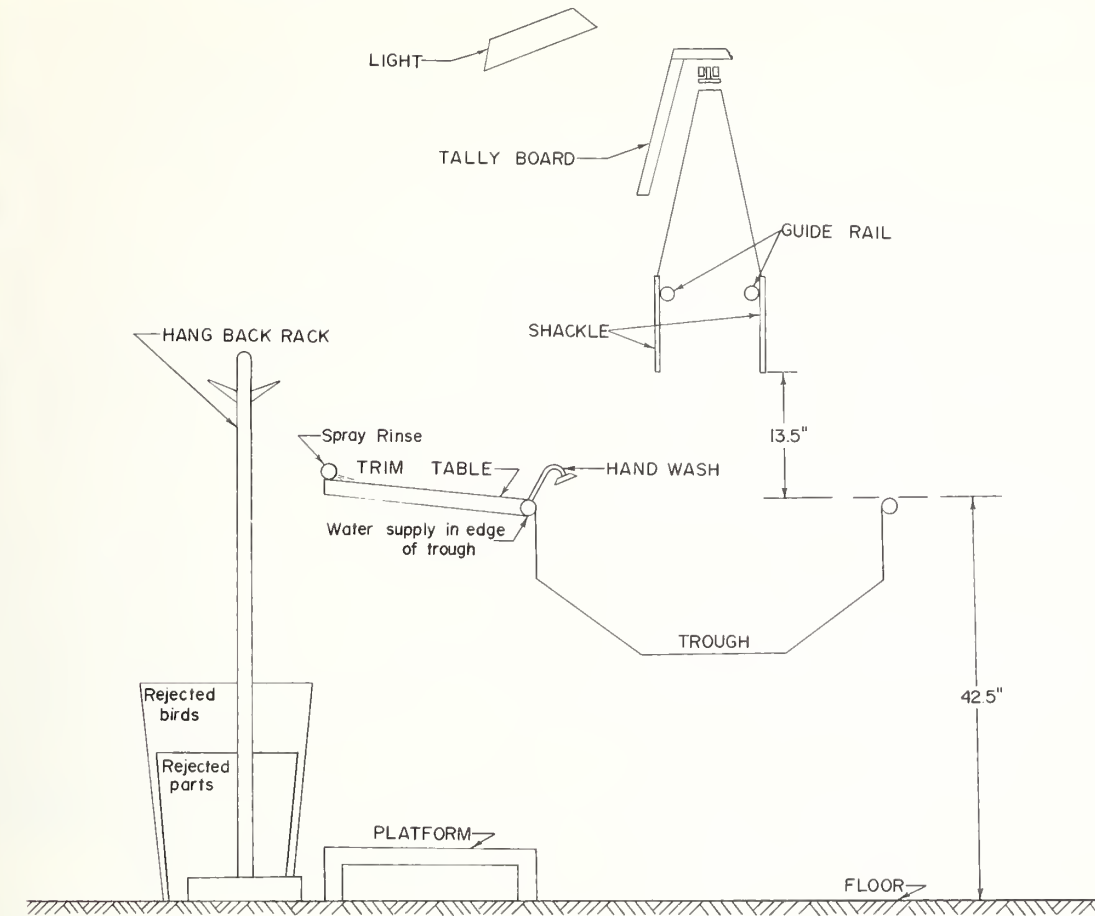


FIGURE 3.—Layout of a typical inspection and trim station.

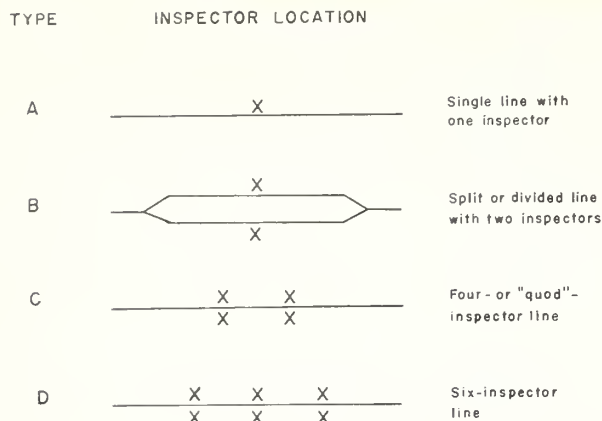


FIGURE 4.—Schematic sketches of four types of eviscerating line-inspector arrangements normally found in poultry processing plants.

physical factors, and learning abilities were equal for all inspectors, differences would probably still exist in the time required for some people to inspect poultry properly. These differences stem from differences in the physical and mental reaction time of individuals.

Many years of experience in poultry inspection has brought out some unusual facts. (1) An inspector does the best job when he works at a production rate between "too slow" and "too fast." If

the rate is too slow, he tends to become bored or let other activities distract him. If too fast, he just does not have time to inspect properly. (2) A high incidence of disease in a flock does not necessarily slow down the inspector proportionately (although it does affect production output drastically). Where a particular unwholesomeness factor persists for a short time in a flock of chickens being processed, the inspector expects it to occur rather consistently throughout the entire flock. When this happens and it involves condemnation, he does not have to complete the entire inspection cycle on the condemned birds, thereby saving some time. (3) The Inspection Act is difficult to administer on an absolutely uniform basis throughout the country because of differences in the interpretation of the meaning of words, judgment of individuals, and local situations.

These factors are pointed out to emphasize that inspection rates must consider judgments rendered by experienced people, involving both psychological and physical factors (such as methods, equipment, product, plant facilities, and other workers) that are involved in the operations. Any established rate for inspection, therefore, must be adjusted by the particular circumstances. It must be set at a pace that the highly skilled person can easily exceed, that the "average" person can maintain throughout the work day, and that the worker lacking somewhat in dexterity can attain by extra effort, while maintaining the quality of workmanship at an acceptable level.

ESTABLISHING FEDERAL INSPECTION RATES

Optimum inspection can be achieved only if the most favorable environment for inspection and trimming is maintained. This includes eliminating unnecessary movements, reducing essential movements to a minimum, providing sufficient, properly directed light and properly positioned carcasses and viscera, and providing other arrangements that contribute to motion economy. In establishing an inspection rate, it must be assumed that most of these requirements have been met.

Basic Inspection Time

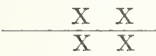
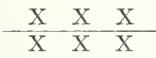
The inspection operation combines visual examination, the sense of touch, and the application of judgment. The basic time for examining a poultry carcass is the time required to inspect it visually. This is the predominant element of the operation. Inspection by touch is carried out during the visual check or in conjunction with manipulation of the bird to view the carcass. It is also essential to consider the element of reaching from one bird to the next when establishing basic time values, because

there is some overlapping between this element and the element of inspection. The type of eviscerating line and the carcass spacing affect both these elements.

Table 1 lists the shackle-spacing distance, the distance the inspector must reach, and the basic time requirements per cycle for inspecting a chicken carcass on the four major types of eviscerating lines.

Table 1 shows that time requirements for basic inspection increase when: (1) The distance between birds is reduced from 12 to 6 inches, and (2) the number of inspectors on a line is increased. The additional time requirement is because of "search" and "reach" factors. Line-type A required 0.003 man-minute per cycle more with 6-inch bird spacing than with 12-inch spacing (about 1.5 birds per minute difference). When two inspectors are working side by side on a line, the "inspect" time is further increased. These factors are accentuated in line-type D with three inspectors working side by side, each inspecting every third carcass.

TABLE 1.—*Chicken-carass inspection: Shackle-spacing distance, distance inspector must reach, and basic time requirements per cycle, 4 major eviscerating lines*

Type of line and number and position of inspectors on line ¹	Distance		Time per cycle		Basic inspection time
	Between birds	Inspector must reach between birds	Reach for bird	Inspect bird	
	Inches	Inches	Man-minutes	Man-minutes	Man-minutes
A 	6	6	0.007	0.037	0.044
A 	12	12	.006	.035	.041
B 	12	12	.006	.035	.041
C 	6	12	.009	.038	.047
D 	6	18	.010	.041	.051

¹ A=single-eviscerating line, 1 inspector; B=split or divided line, 2 inspectors; C=quad line, 4 inspectors; D=6-inspector line. X denotes position of inspector at eviscerating line (fig. 2).

Time Required for Condemnations and Other Duties

There are certain recurring actions beyond those routine movements required for inspecting a carcass for which allowances must be established. For example, when the inspector condemns a bird, he unshackles one leg of the bird and tells the trimmer the reason for condemnation. If the inspector is uncertain whether a bird should be condemned, he unshackles one leg of the bird and tells the trimmer to hang the bird back for an acceptance or rejection by the veterinarian in charge. The inspector washes his hands in a spray after handling a condemned carcass or one of doubtful wholesomeness or as often as necessary.

The percentage and type of carcass defects encountered also must be considered in establishing rates for properly inspecting chickens. Each type of defect triggers a series of additional operations that must be performed each time it occurs. When a part of the carcass shows contamination, the inspector uses some decision-making time and signals the trimmer. The trimmer picks up a knife, cuts off the part involved, discards it in a can, lays the knife down, and washes his hands. Light or heavy bruises, pin feathers, or an unwholesome carcass or viscera trigger other "trimmer" operations.

When a poor evisceration job occurs, it frequently involves poor venting or drawing of the viscera and the inspector must expend additional

time to verify the absence of contamination. When contamination is involved, it frequently occurs in the lumbar region of the back. The angle of presentation and the transverse processes of the vertebrae make this perhaps the most difficult region of the interior to inspect. Thus verification of the presence or absence of suspected contamination in this region requires considerable time. Where this condition persists, the inspectors are required to decrease the line speed. The reduced rate of production permits a more thorough examination, allows additional time for trimming away contaminated tissue, and gives the eviscerating crew more time, which results in better workmanship on the venting and drawing processes.

Findings in the studies showed that the trimmer performed many duties that did not require the attention of, or a signal from, the inspector. Therefore the established rate involves only those operations in which trimming affects the inspector's time.

Typically, the allowance for certain trim operations included that time required for the inspector to unshackle one leg as a signal. The allowance for condemnation would be the unshackling time plus the time required for the inspector to wash his hands (required each time a questionable or a condemned bird is handled). Table 2 lists the time requirements for the inspector to unshackle one leg of a bird and to wash his hands.

Time values are also shown in table 2 for certain abnormal inspection duties so that allowances

TABLE 2.—*Time required for the inspector to perform normal and abnormal inspection operations*

Operation	Time required
Normal: ¹	Man-minutes
Wash hands-----	0.016
Unshackle one leg (signal to trimmer)---	.020
Normal: ¹	
Abnormal:	
Inspect viscera on shackle-----	.009
Untangle shackles-----	.012
Place leg in shackle-----	.008
Complete viscera draw-----	.018
Turn bird around-----	.009

¹ Allowances for normal inspection operations must be included in established inspection rate.

could be made for them in computing the overall inspection rate. An inspector's rhythm was disturbed by frequent minor irregularities in carcass preparation, equipment function, or bird presentation. These irregularities include such things as examining viscera hung on the shackle, untangling shackles, and completing a poor viscera-drawing operation. It was not practical to establish time values for certain types of abnormal conditions such as the effects of loose-bowelled chickens on the inspection and trim operations.

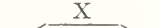
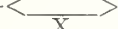
Inspection Rates

Establishing a universal rate of inspection is impractical. This is true even in plants using similar equipment, because the rate is a function of the basic inspection time (reach plus inspection) and the allowances required for other duties. Time requirements for these items vary from plant to plant. The rates in this report, therefore, are based on the national condemnation average for 1965, and the trim rate average occurring in the plants during this study. These rates are established as guidelines, and the individual plant will have to assess its own operation and make necessary adjustments—especially for such items as inspecting the viscera on a shackle, untangling a shackle, placing the leg of a bird in the shackle, completing the viscera draw, and turning the bird around. Most of these items can be eliminated on the eviscerating line by adequate equipment maintenance and proper supervision by management.

The condemnation average for the entire industry for 1965 was 2.7 percent. Therefore, the allowance for condemnation used in this report is 2.7 percent, and that for inspector involvement in trim operations is 8 percent (the percentage of birds requiring additional time of the Federal inspector).

Table 3 reflects the established inspection rates for the four basic types of eviscerating lines and inspection station arrangements, with the resulting number of birds inspected per minute under each arrangement.

TABLE 3.—*Inspection rates established for chickens and corresponding line speeds for basic types of eviscerating lines and Federal inspection station arrangements*

Type of line and number and position of inspectors on line ¹	Shackle spacing	Inspector's reach ²	Conveyor speed per minute at this rate	Inspection time				Birds inspected per minute
				Basic time per cycle	Condemnation allowance ³	Trim allowance ⁴	Total	
	Inches	Inches	Inches	Man-minutes	Man-minutes	Man-minutes	Man-minutes	Number
A 	6	6	10.6	0.044	0.001	0.002	0.047	21.3
A 	12	12	22.7	.041	.001	.002	.044	22.7
B 	12	12	22.7	.041	.001	.002	.044	22.7
C 	6	12	20.0	.047	.001	.002	.050	20.0
D 	6	18	27.7	.051	.001	.002	.054	18.5

¹ See footnote 1, table 1.

² Birds also travel this distance during inspection cycle.

³ Unshackle leg and wash hands on 2.7 percent of birds inspected.

⁴ Unshackle leg on 8 percent of birds inspected.

MODEL PLANTS

Manpower requirements cannot be established for every possible combination of methods and equipment used currently in poultry processing plants. Therefore, through linear programming, manpower requirements have been established for the four basic eviscerating line types illustrated in figure 2 using methods and equipment selected as being the most widely used and efficient (based on the time values reported in the earlier study given in footnote 2 and developed and verified in this study; see Appendix). Production rates used for all methods in the model plants are listed in the Appendix.

These manpower requirements for model plants are established here to illustrate the differences between types of equipment and potentials at various production levels. In addition, they show how a balance can be achieved between inspectors and plant workers on the eviscerating line and the levels of production necessary for best utilization of manpower based on methods and equipment specified.

These figures can be used by management of any plant for comparative purposes by making adjustments in the particular methods and equipment used.

Manpower requirements for eviscerating lines with from one to six Federal inspectors are shown in tables 4 to 8. The rate of production varies from 900 through 7,200 birds per hour. The number of workers required and the percentage of manpower utilization for each operation are given at each production level.

These tables show the number of birds processed per man-hour expended, including and excluding wrapping and stuffing giblets. These figures provide a guide both for plants whose principal operation is further processing as well as for plants who are only ice-packing whole birds.

Italic figures in the tables indicate production levels at approximately 100 percent utilization of inspection labor. The tables continue on to 110 percent utilization based on the rates established from the study reported here. These data allow the processor to examine the possibilities of increased production and indicate what advantages might occur by providing the best inspection environment possible.

One-Inspector Lines

Table 4 shows figures for one-inspector lines with birds spaced on 6- and 12-inch centers. Rates for both spacings are shown since there is a difference of 1.4 birds per minute (21.3 to 22.7) between

the established inspection rates for the two arrangements of bird presentation.

With the one-inspector line arrangement, the number of birds processed per man-hour steadily increases at production rates from 1,000 through 1,500 birds per hour. However, a single inspector reaches his established rate of inspection (100 percent) at about 1,300 birds per hour with birds on 6-inch centers and at just under 1,400 birds per hour with birds on 12-inch centers. Under ideal conditions and with a low incidence of carcass condemnation, an inspector with above-average ability possibly could exceed the established production rates. He could perform satisfactorily at 1,400 birds per hour when the carcasses are hung on 6-inch centers and 1,500 when they are hung on 12-inch centers.

Under this arrangement, as shown in table 4, the birds per man-hour rate for the eviscerating operation can be expected to vary between 70 and 75—possibly averaging out at 72 (including wrap and stuff giblets).

Two-Inspector Lines

The manpower requirements for a split line (type B) with two Federal inspectors are shown in table 5.

The output per man-hour produced by the eviscerating crew varies about 9.5 birds through the production range of 1,600 to 3,000 birds per hour. In the middle of this range (at 2,400 birds per hour), however, the output reaches its highest level—77.4 birds per man-hour. Inspection personnel would be working at 88.1 percent of the established standard at this production level. These data illustrate that the best labor utilization does not always exist at the production level where maximum utilization of the inspector's time occurs.

The two-inspector line arrangement allows the greatest production rates for Federal inspectors of any type studied. If production is to exceed the limits of this arrangement, however, another type of arrangement (the quad for instance) ought to be considered for possible advantages in overall space and manpower utilization.

Four-Inspector Lines

The four-inspector or quad line is an extremely popular arrangement in the industry. It provides good manpower and space utilization for a medium-sized processing plant. Utilization of inspection manpower is reduced somewhat by 6-inch bird

TABLE 4.—Single-eviscerating line with one Federal inspector (type A): Manpower requirements and percentage utilization of line employees and Federal inspector at various production rates¹

Production per hour (birds)	Transfer birds (34.4) ²			Remove oil glands (36.8) ²			Open birds (38.8) ²			Draw vents (15.6) ²			Draw viscera (13.7) ²			Federal inspection with birds on—						Trim hearts and livers (14.2) ²								
	Work- ers			Work- ers			Work- ers			Work- ers			Work- ers			6" centers (21.3) ²			12" centers (22.7) ²			Trim- mers			Work- ers			Man- power utiliza- tion		
	Num- ber	Per- cent	Man- power utiliza- tion	Num- ber	Per- cent	Man- power utiliza- tion	Num- ber	Per- cent	Man- power utiliza- tion	Num- ber	Per- cent	Man- power utiliza- tion	Num- ber	Per- cent	Man- power utiliza- tion	Num- ber	Per- cent	Man- power utiliza- tion	Num- ber	Per- cent	Man- power utiliza- tion	Num- ber	Per- cent	Man- power utiliza- tion	Num- ber	Per- cent	Man- power utiliza- tion			
900-----	1	43.6	1	40.8	38.7	1	38.7	1	96.1	1	109.4	1	70.4	1	66.1	1	66.1	1	66.1	1	66.1	1	105.6							
1,000-----	1	48.5	1	45.4	42.9	1	42.9	2	60.9	2	60.9	1	78.4	1	73.4	1	73.4	1	73.4	1	73.4	2	58.1							
1,100-----	1	53.2	1	49.7	47.2	2	47.2	2	58.8	2	66.8	1	85.9	1	80.8	1	80.8	1	80.8	1	80.8	2	64.4							
1,200-----	1	58.1	1	54.3	51.5	2	51.5	2	64.1	2	73.0	1	93.9	1	88.1	1	88.1	1	88.1	1	88.1	2	70.4							
1,300-----	1	62.8	1	58.7	55.8	2	55.8	2	69.4	2	79.2	1	101.9	1	95.4	1	95.4	1	95.4	1	95.4	2	76.4							
1,400-----	1	67.7	1	63.3	60.1	2	60.1	2	74.8	2	85.0	1	109.4	1	102.8	1	102.8	1	102.8	1	102.8	2	99.7							
1,500-----	1	72.7	1	67.9	64.1	2	64.1	2	80.1	2	91.2	---	---	---	110.1	1	110.1	1	110.1	1	110.1	2	88.0							

Work- ers	Remove and trim gizzards (11.7) ²			Remove lungs (24.9) ²			Ship neck vertebras (37.0) ²			Remove crops and windpipes (21.1) ²			Peel gizzards (38.2) ²			Total workers, excluding wrapping and stuffing giblets ³			Bards per man- hour ¹			Wrap and stuff giblets (12.8) ²			Bards per man- hour		
	Work- ers			Work- ers			Work- ers			Work- ers			Work- ers			Number and stuffing giblets ³			per hour ¹			Work- ers			All work- ers		
	Man- power utiliza- tion	Work- ers	Man- power utiliza- tion	Man- power utiliza- tion	Work- ers	Man- power utiliza- tion	Man- power utiliza- tion	Work- ers	Man- power utiliza- tion	Man- power utiliza- tion	Work- ers	Man- power utiliza- tion	Man- power utiliza- tion	Work- ers	Man- power utiliza- tion	Man- power utiliza- tion	Number	Per- cent	Man- power utiliza- tion	Man- power utiliza- tion	Work- ers	Man- power utiliza- tion	Man- power utiliza- tion	Num- ber	Per- cent	Man- power utiliza- tion	
900-----	2	64.1	1	60.2	40.5	1	40.5	1	71.1	1	39.3	1	13	69.2	13	69.2	15	60.0	15	58.6	15	60.0					
1,000-----	2	71.3	1	66.9	45.0	1	45.0	1	79.0	1	43.6	1	15	66.7	15	66.7	17	58.8	17	64.8	17	58.8					
1,100-----	2	78.3	1	73.6	49.6	1	49.6	1	86.9	1	48.0	1	16	68.7	16	68.7	18	61.1	18	71.5	18	61.1					
1,200-----	2	85.5	1	80.3	54.1	1	54.1	1	94.8	1	52.4	1	16	75.0	16	75.0	18	66.7	18	78.1	18	66.7					
1,300-----	2	92.6	1	87.0	58.6	1	58.6	1	102.7	1	56.4	1	16	81.2	16	81.2	18	72.7	18	84.5	18	72.7					
1,400-----	2	99.7	1	93.7	63.1	1	63.1	1	55.2	2	61.1	1	17	82.3	17	82.3	19	73.7	19	90.6	19	73.7					
1,500-----	2	106.8	1	100.4	67.6	1	67.6	1	59.2	2	65.5	1	17	88.2	17	88.2	19	78.9	19	97.7	19	78.9					

¹ Maximum manpower allocated on an operation is 110 percent of established production rate (fig. 2, p. 4, schematic sketch of line, and p. 3, for description.)

² Established rate in birds per minute per worker (see Appendix.)

³ Excludes Federal inspectors.

spacing compared with the split line with 12-inch spacing. Because the inspectors examine alternate birds on the line, the time for the element search is increased and more manipulation of the carcass is required for exterior inspection.

The best labor utilization for this type of line (table 6) occurs between 4,100 and 5,100 birds per hour, with peaks at 4,500 and 4,800 birds. Inspector utilization is 93.7 percent at 4,500 birds per hour and eviscerating labor is processing at 80.3 birds per man-hour. At 4,800 birds per hour inspector effort is at 100 percent and the line crew is processing 80 birds per worker. Although the production rate per eviscerating worker does not drop sharply at rates above 4,800 birds per hour, the inspectors' efforts have to be extended considerably beyond 100 percent to keep up with the higher rates; therefore, the advisability of extending into the higher rates would depend on circumstances at individual plants.

Four-Inspector Lines—Special Arrangement

A special arrangement of the four-inspector line, a combination of line types B and C, utilizes some of the advantages of both in one operation. This is accomplished, to a degree, by dividing each side of a quad line so that birds are presented for inspection on 12-inch centers as in line-type B (fig. 5). Normally, four inspectors can handle up to 5,400 birds per hour while evisceration workers are working at 76.1 birds per hour per worker (table 7).

This particular arrangement gets better utilization of Federal inspectors compared with the four inspectors on the normal quad line. However, overall labor utilization or production per man-hour is not as good generally as the quad line. The reason for this is that the "draw-viscera" operation is also divided and requires two additional workers.

Six-Inspector Lines

The six-inspector line arrangement is usually an extension of the four-inspector line—one additional inspection station is added to each side of the eviscerating line. This arrangement can be advantageously used to increase overall plant production by about 40 percent. Up to 50 percent more space than is used in the four-inspector line is required to extend the eviscerating line to accommodate additional workers.

At a production rate of 6,500 birds per hour, the output per worker averages 79.3 birds per man-hour with effort input of inspection personnel at 97.6 percent of normal. At 100 percent of inspector effort, the production reaches 6,700 birds per hour with a slight drop in worker output to 78.8 birds per man-hour (table 8).

Productivity of inspection personnel is reduced to 18.5 birds per minute (1.5 less than the quad line) because each inspector examines every third carcass, making the reach distance for each inspection 18 inches (bird spacing is 6 inches on center; see table 3).

Text continued on page 20

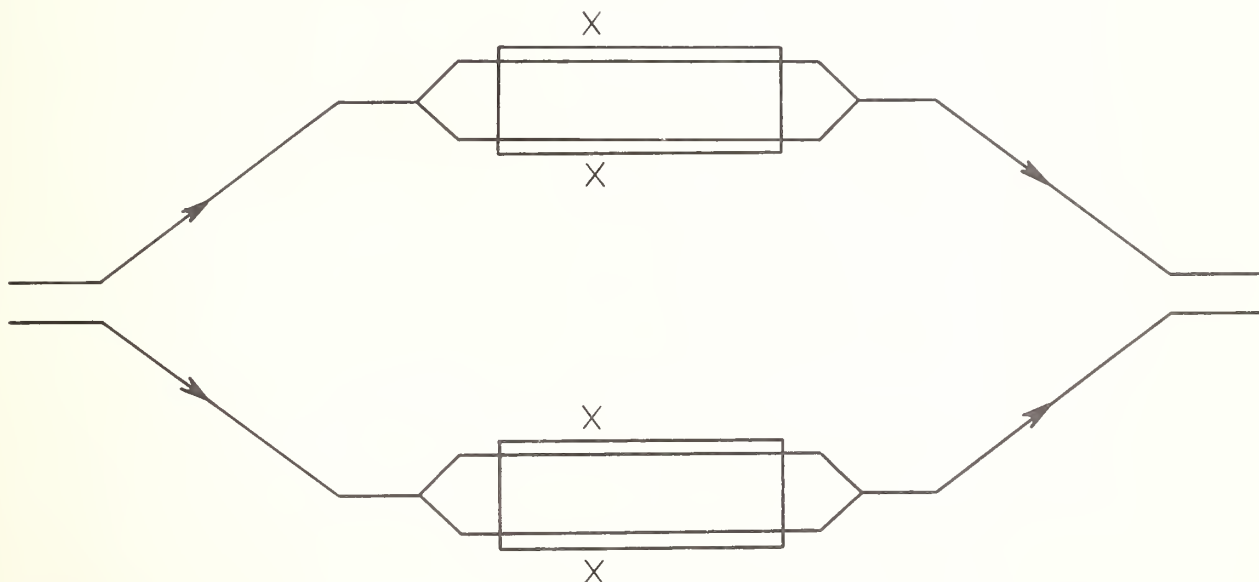


FIGURE 5.—Schematic diagram showing how dual conveyors are divided to provide 12-inch shackle spacing for four Federal inspectors (special arrangement).

TABLE 5.—*Split-eviscerating line with 2 Federal inspectors (type B): Manpower requirements and percentage of utilization of the line workers and Federal inspectors*¹

Pro- duction per hour (birds)	Transfer birds (34.4) ²		Remove oil glands (36.8) ²		Open birds (36.8) ²		Draw vents (15.6) ²		Draw viscera (13.7) ²		Federal inspec- tion (22.7) ²		Trim hearts and livers (14.2) ²		Remove and trim gizzards (11.7) ²	
	Man- power utiliza- tion		Man- power utiliza- tion		Man- power utiliza- tion		Man- power utiliza- tion		Man- power utiliza- tion		Man- power utiliza- tion		Man- power utiliza- tion		Man- power utiliza- tion	
	Work- ers	Percent	Work- ers	Percent	Work- ers	Percent	Work- ers	Percent	Work- ers	Percent	Work- ers	Percent	Work- ers	Percent	Work- ers	Percent
1,600----	1	77.6	1	72.6	1	68.7	2	85.5	2	97.3	2	58.8	2	94.0	3	76.0
1,700----	1	82.3	1	76.9	1	73.0	2	90.8	2	103.4	2	62.3	2	99.6	3	80.7
1,800----	1	87.2	1	81.5	1	77.3	2	96.2	2	109.5	2	66.1	2	105.6	3	85.5
1,900----	1	92.1	1	86.1	1	81.6	2	101.5	4	57.7	2	69.8	3	74.4	3	90.2
2,000----	1	96.8	1	90.5	1	85.9	2	106.8	4	60.8	2	73.3	3	78.2	3	95.0
2,100----	1	101.7	1	95.1	1	90.2	3	74.8	4	64.0	2	77.1	3	82.1	3	99.7
2,200----	1	106.6	1	99.7	1	94.5	3	78.3	4	66.9	2	80.1	3	86.1	3	104.4
2,300----	2	55.7	1	104.1	1	98.8	3	81.9	4	69.9	2	84.4	3	89.9	3	109.2
2,400----	2	58.1	1	108.7	1	103.1	3	85.5	4	73.0	2	88.1	3	93.9	4	85.5
2,500----	2	60.6	2	56.6	1	107.4	3	89.0	4	76.0	2	91.8	3	97.9	4	89.0
2,600----	2	62.9	2	58.8	2	55.8	3	92.6	4	79.1	2	95.4	3	101.4	4	92.6
2,700----	2	63.4	2	61.1	2	58.0	3	96.2	4	82.1	2	99.1	3	105.6	4	96.2
2,800----	2	67.9	2	63.4	2	60.1	3	99.7	4	85.1	2	102.9	3	109.6	4	99.7
2,900----	2	70.2	2	65.6	2	62.3	3	103.3	4	88.2	2	106.4	4	85.0	4	103.3
3,000----	2	72.7	2	67.9	2	64.4	3	106.8	4	91.2	2	110.0	4	88.0	4	106.8

See footnotes at end of table.

TABLE 5.—*Split-eviscerating line with 2 Federal inspectors (type B): Manpower requirements and percentage of utilization of the line workers and Federal inspectors*¹—Continued

Produce- tion per hour (birds)	Remove lungs (24.9) ²			Ship neck vertebras (37.0) ²			Remove crops and windpipes (21.1) ²			House inspection (20.0) ²			Peel gizzards (38.2) ²			Total workers, excluding wrapping and stuffing giblets ³			Wrap and stuff giblets (12.8) ²			All work- ers ³	Birds per man- hour
	Number	Percent	Man- power utiliza- tion	Number	Percent	Man- power utiliza- tion	Number	Percent	Man- power utiliza- tion	Number	Percent	Man- power utiliza- tion	Number	Percent	Man- power utiliza- tion	Number	Percent	Man- power utiliza- tion	Number	Percent	Man- power utiliza- tion		
1,600-----	1	107.1		1	72.1		2	63.2		2	66.7		1	69.8		21	76.2		2	104.3		23	69.6
1,700-----	2	56.9		1	76.6		2	67.1		2	70.7		1	74.2		22	77.3		3	73.7		25	68.0
1,800-----	2	60.2		1	81.1		2	71.1		2	75.0		1	78.5		22	81.8		3	78.1		25	72.0
1,900-----	2	63.6		1	85.6		2	75.0		2	79.2		1	82.9		25	76.0		3	82.3		28	67.9
2,000-----	2	66.9		1	90.1		2	79.0		2	83.2		1	87.3		25	80.0		3	86.7		28	71.4
2,100-----	2	70.3		1	94.6		2	82.9		2	87.5		1	91.6		26	80.8		3	91.1		29	72.4
2,200-----	2	73.6		1	99.1		2	86.9		2	91.7		1	96.0		26	84.6		3	95.3		29	75.9
2,300-----	2	77.0		1	103.6		2	90.8		2	95.7		1	100.4		27	85.2		3	99.7		30	76.7
2,400-----	2	80.3		1	108.1		2	94.8		2	100.0		1	104.7		28	85.7		3	104.2		31	77.4
2,500-----	2	83.7		2	56.1		2	98.7		2	104.2		1	109.1		30	83.3		3	108.6		33	75.8
2,600-----	2	87.0		2	58.6		2	102.7		2	108.2		2	56.7		32	81.3		4	84.5		36	72.2
2,700-----	2	90.4		2	60.8		2	106.6		3	75.0		2	58.9		33	81.8		4	87.9		37	73.0
2,800-----	2	93.7		2	63.1		3	73.7		3	77.8		2	61.1		34	82.4		4	91.2		38	73.7
2,900-----	2	97.1		2	65.3		3	76.4		3	80.5		2	63.3		35	82.9		4	94.5		39	74.4
3,000-----	2	100.4		2	67.6		3	79.0		3	83.3		2	65.5		35	85.7		4	97.7		39	76.9

¹ Line divides for viscera draw, Federal inspection, and trim with birds on 12-inch centers at these points (fig. 2, p. 4, for schematic sketch of line, and p. 3, for description). Maximum manpower allocated is 110 percent of

established production rates.

² Established rate in birds per minute per workers (see Appendix).

³ Excludes Federal inspectors.

TABLE 6.—*Double-eviscerating line with 4 Federal inspectors (type C): Manpower requirements and percentage of utilization of line workers and Federal inspectors at various rates*¹

Produc- tion per hour (birds)	Transfer birds (34.4) ²		Remove oil glands (36.8) ³ (33.0) ⁴		Open birds (38.8) ²		Draw vents (15.6) ²		Draw viscera (13.7) ²		Federal inspection (20.0) ²		Trim hearts and livers (14.2) ²		Remove and trim gizzards (11.7) ²	
	Num- ber	Per- cent	Work- ers	Man- power utiliza- tion	Num- ber	Per- cent	Work- ers	Man- power utiliza- tion	Num- ber	Per- cent	Work- ers	Man- power utiliza- tion	Num- ber	Per- cent	Work- ers	Man- power utiliza- tion
3,100----	2	75.0	2	70.2	2	66.6	4	82.8	4	94.3	4	64.6	4	91.0	6	73.6
3,200----	2	77.3	2	72.5	2	68.7	4	85.4	4	97.3	4	66.6	4	93.8	6	75.9
3,300----	2	79.4	2	74.7	2	70.9	4	88.1	4	100.4	4	68.7	4	96.8	6	78.3
3,400----	2	82.3	2	76.9	2	73.1	4	90.8	4	103.4	4	70.9	4	99.8	6	80.8
3,500----	2	84.8	2	79.2	2	75.2	4	93.5	4	106.4	4	72.9	4	102.7	6	83.1
3,600----	2	87.2	2	81.5	2	77.3	4	96.2	4	109.4	4	75.0	4	105.6	6	85.5
3,700----	2	89.6	2	83.8	2	79.5	4	98.8	6	75.0	4	77.1	4	108.6	6	87.8
3,800----	2	92.1	2	86.0	2	81.6	4	101.5	6	77.0	4	79.2	4	74.3	6	90.2
3,900----	2	94.5	2	88.3	2	83.8	4	104.2	6	79.1	4	81.1	4	76.3	6	92.6
4,000----	2	96.9	2	90.6	2	85.9	4	106.8	6	81.1	4	83.3	4	78.2	6	95.0
4,100----	2	99.3	2	92.8	2	88.0	4	109.5	6	83.1	4	85.4	4	80.2	6	97.4
4,200----	2	101.7	2	95.1	2	90.2	6	74.8	6	85.2	4	87.5	4	82.2	6	99.8
4,300----	2	104.2	2	97.4	2	92.3	6	76.6	6	87.2	4	89.6	4	84.1	6	102.2
4,400----	2	106.6	2	99.6	2	94.5	6	78.3	6	89.2	4	91.7	4	86.1	6	104.6
4,500----	2	109.0	2	101.9	2	96.6	6	80.1	6	91.2	4	93.7	4	88.0	6	107.0
4,600----	4	55.7	2	104.1	2	98.8	6	81.9	6	93.3	4	95.8	4	90.0	6	109.4
4,700----	4	56.9	2	106.4	2	100.9	6	83.7	6	95.3	4	97.9	4	91.9	8	83.7
4,800----	4	58.1	2	108.7	2	103.1	6	85.5	6	97.3	4	100.0	4	93.9	8	85.5
4,900----	4	59.3	3	82.4	2	105.2	6	87.2	6	99.3	4	102.1	4	95.8	8	87.2
5,000----	4	60.6	3	84.1	2	107.4	6	89.0	6	101.4	4	104.2	4	97.8	8	89.0
5,100----	4	61.8	3	85.8	2	109.5	6	90.8	6	103.4	4	106.2	4	99.8	8	90.8
5,200----	4	63.0	3	87.6	4	55.9	6	92.6	6	105.5	4	108.4	6	101.8	8	92.6

See footnotes at end of table.

TABLE 6.—*Double-eviscerating line with 4 Federal inspectors (type C): Manpower requirements and percentage of utilization of line workers and Federal inspectors at various rates*¹—Continued

Produce- tion per hour (birds)	Remove lungs (24.9) ²		Snip neck vertebras (37.0) ²		Remove crops and windpipes (21.1) ²		House inspection (20.0) ²		Peel gizzards (38.2) ²		Total workers, excluding wrapping and stuffing giblets ³		Birds per man- hour ¹		Wrap and stuff giblets (12.8) ²		All work- ers ⁵	Birds per man- hour
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent		
3,100----	2	103.8	2	69.9	4	61.2	4	64.6	2	67.7	42	73.8	4	101.0	46	67.4		
3,200----	2	107.0	2	72.0	4	63.2	4	66.6	2	70.0	42	76.2	4	104.1	46	69.6		
3,300----	4	55.2	2	74.3	4	65.2	4	68.7	2	72.0	44	75.0	4	107.4	48	68.7		
3,400----	4	56.9	2	76.6	4	67.1	4	70.9	2	74.2	44	77.4	5	88.5	49	69.4		
3,500----	4	58.6	2	78.8	4	69.1	4	73.0	2	76.4	44	79.5	5	91.1	49	71.4		
3,600----	4	60.2	4	81.1	4	71.1	4	75.0	2	78.6		78.3	5	93.8	51	70.5		
3,700----	4	61.9	2	83.3	4	73.1	4	77.0	2	80.7	46	80.4	5	96.1	51	72.5		
3,800----	4	63.6	2	85.6	4	75.0	4	79.0	2	82.9	48	79.1	5	98.9	53	71.7		
3,900----	4	65.3	2	87.9	4	77.0	4	81.2	2	85.1	48	81.3	5	101.6	53	73.6		
4,000----	4	66.9	2	90.1	4	79.0	4	83.3	2	87.3	48	83.3	5	103.9	53	75.5		
4,100----	4	68.6	2	92.4	4	81.0	4	85.4	2	89.4	48	85.4	5	106.3	53	77.4		
4,200----	4	70.3	2	94.6	4	82.9	4	87.5	2	91.6	50	84.0	5	109.4	55	76.4		
4,300----	4	71.9	2	96.9	4	84.9	4	89.6	2	93.8	50	86.0	6	93.0	56	76.8		
4,400----	4	73.6	2	99.1	4	86.9	4	91.7	2	95.9	50	88.0	6	95.3	56	78.5		
4,500----	4	75.3	2	101.4	4	88.9	4	93.7	2	98.2	50	90.0	6	97.7	56	80.3		
4,600----	4	76.9	2	103.6	4	90.8	4	95.8	2	100.4	52	88.5	6	100.0	58	79.3		
4,700----	4	78.6	2	105.9	4	92.8	4	98.0	2	102.5	54	87.0	6	102.3	60	78.3		
4,800----	4	80.3	2	108.1	4	94.8	4	100.0	2	104.7	54	88.9	6	103.9	60	80.0		
4,900----	4	81.9	4	55.2	4	96.8	4	102.1	2	106.9	57	86.0	6	106.3	63	77.8		
5,000----	4	83.7	4	56.3	4	98.7	4	104.2	2	109.0	57	87.7	6	108.6	63	79.4		
5,100----	4	85.3	4	57.4	4	100.7	4	106.2	3	74.2	58	87.9	7	94.9	65	78.5		
5,200----	4	87.0	4	58.6	4	102.7	4	108.3	3	75.7	60	86.6	7	96.8	67	77.6		

¹ Maximum manpower allocated on an operation is 110 percent of established production rate (fig. 2, p. 4, for schematic sketch of line, and p. 3 for description).² Established rate in birds per minute (see Appendix).³ 2 workers remove glands on eviscerating line.⁴ 3 workers remove glands on picking line.⁵ Excludes Federal inspectors.

TABLE 7.—Double-eviscerating line (divided similar to type B) with 4 Federal inspectors: Manpower requirements and percentage of utilization of line workers and Federal inspectors¹

Production per hour (birds)	Transfer birds (34.4) ²			Remove oil glands (36.8) (33.0) ⁴			Open birds (38.8) ²			Draw viscera (13.7) ²			Federal inspection (22.7) ²			Trimmers			Trim hearts and livers (14.2) ²			Remove and trim gizzards (11.7) ²		
	Num-ber	Per-cent	Man-power utilization	Num-ber	Per-cent	Man-power utilization	Num-ber	Per-cent	Man-power utilization	Num-ber	Per-cent	Man-power utilization	Num-ber	Per-cent	Man-power utilization	Num-ber	Per-cent	Man-power utilization	Num-ber	Per-cent	Man-power utilization	Num-ber	Per-cent	Man-power utilization
4,000----	2	96.9		2	90.6		2	85.9		4	106.8		4	74.0		4	74.0		6	78.2		6	95.0	
4,100----	2	99.3		2	92.8		2	88.0		8	109.5		4	75.8		4	75.8		6	80.2		6	97.4	
4,200----	2	101.7		2	95.1		2	90.2		8	74.8		4	77.7		4	77.7		6	82.1		6	99.8	
4,300----	2	104.2		2	97.4		2	92.3		8	76.6		4	79.5		4	79.5		6	84.1		6	102.2	
4,400----	2	106.6		2	99.6		2	94.5		8	78.4		4	81.4		4	81.4		6	86.1		6	104.6	
4,500----	2	109.0		2	101.9		2	96.6		6	80.1		4	83.2		4	83.2		6	88.0		6	107.0	
4,600----	4	55.7		2	104.2		2	98.8		8	81.9		4	85.1		4	85.1		6	90.0		6	109.4	
4,700----	4	56.9		2	106.4		2	100.9		8	83.7		4	86.9		4	86.9		6	91.9		8	83.7	
4,800----	4	58.1		2	108.7		2	103.1		8	85.5		4	88.7		4	88.7		6	93.9		8	85.5	
4,900----	4	59.4		3	82.4		2	105.2		8	87.3		4	90.6		4	90.6		6	95.9		8	87.2	
5,000----	4	60.6		3	84.1		2	107.3		8	89.0		4	92.4		4	92.4		6	97.8		8	89.0	
5,100----	4	61.8		3	85.8		2	109.5		8	90.8		4	94.3		4	94.3		6	99.7		8	90.8	
5,200----	4	63.0		3	87.6		4	55.9		8	92.6		4	96.1		4	96.1		6	101.8		8	92.6	
5,300----	4	64.2		3	89.2		4	57.0		8	94.4		4	98.8		4	98.8		6	103.6		8	94.3	
5,400----	4	65.5		3	90.9		4	58.0		8	96.2		4	99.8		4	99.8		6	105.6		8	96.1	
5,500----	4	66.7		3	92.6		4	59.1		8	97.9		4	101.7		4	101.7		6	107.6		8	97.9	
5,600----	4	67.9		3	94.2		4	60.2		8	99.7		4	103.5		4	103.5		6	109.5		8	99.6	
5,700----	4	69.1		3	95.9		4	61.3		8	101.5		4	105.4		4	105.4		8	83.6		8	101.4	
5,800----	4	70.3		3	97.7		4	62.3		8	103.3		4	107.2		4	107.2		8	85.1		8	103.2	
5,900----	4	71.6		3	99.3		4	63.4		8	105.1		4	109.1		4	109.1		8	86.5		8	104.9	
6,000----	4	72.8		3	101.0		4	64.5		8	106.8		4	110.9		4	110.9		8	88.0		8	106.7	

See footnotes at end of table.

TABLE 7.—*Double-eviscerating line (divided similar to type B) with 4 Federal inspectors: Manpower requirements and percentage of utilization of line workers and Federal inspectors*¹—Continued

Production per hour (birds)	Remove lungs (24.9) ²		Strip neck vertebras (37.0) ²		Remove crops and windpipes (21.1) ²		House inspection (20.0) ²		Peel gizzards (38.2) ²		Total workers, excluding wrapping and stuffing giblets ³		Birds per man- hour ¹		Wrap and stuff giblets (12.8) ²		All work- ers ³	Birds per man- hour
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent		
4,000----	4	66.9	2	90.1	4	79.0	4	83.3	2	87.2	50	103.9	5	103.9	55	72.7		
4,100----	4	68.6	2	92.4	4	81.0	4	85.4	2	89.4	50	106.3	5	106.3	55	74.5		
4,200----	4	70.2	2	94.6	4	82.9	4	87.5	2	91.6	52	109.4	5	109.4	57	73.7		
4,300----	4	71.9	2	96.9	4	84.9	4	89.6	2	93.8	52	109.4	6	93.0	58	74.1		
4,400----	4	73.6	2	99.1	4	86.8	4	91.7	2	95.9	52	109.4	6	95.3	58	75.9		
4,500----	4	75.3	2	101.4	4	88.8	4	93.7	2	98.1	52	109.4	6	97.7	58	77.6		
4,600----	4	76.9	2	103.6	4	90.8	4	95.8	2	100.3	54	100.0	6	100.0	60	76.7		
4,700----	4	78.6	2	105.9	4	92.8	4	97.9	2	102.3	56	102.3	6	102.3	62	75.8		
4,800----	4	80.3	2	108.1	4	94.7	4	100.0	2	104.6	56	103.9	6	103.9	62	77.4		
4,900----	4	82.0	4	55.2	4	96.7	4	102.1	2	106.8	59	106.3	6	106.3	65	75.4		
5,000----	4	83.6	4	56.3	4	98.7	4	104.2	2	109.0	59	108.6	6	108.6	65	76.9		
5,100----	4	85.3	4	57.4	4	100.7	4	106.2	3	74.2	60	94.5	7	94.5	67	76.1		
5,200----	4	87.0	4	58.5	4	102.7	4	108.3	3	75.7	62	96.9	7	96.9	69	75.4		
5,300----	4	88.7	4	59.7	4	104.6	6	73.6	3	77.1	64	99.2	7	99.2	71	74.6		
5,400----	4	90.3	4	60.8	4	106.6	6	75.0	3	78.6	64	100.4	7	100.4	71	76.1		
5,500----	4	92.0	4	61.9	4	108.6	6	76.4	3	80.0	64	102.3	7	102.3	71	77.5		
5,600----	4	93.7	4	63.0	6	73.7	6	77.8	3	81.5	66	103.9	7	103.9	73	76.7		
5,700----	4	95.4	4	64.2	6	75.0	6	79.2	3	82.9	68	105.9	7	105.9	75	76.0		
5,800----	4	97.0	4	65.3	6	75.0	6	79.2	3	82.9	68	107.8	7	107.8	75	77.3		
5,900----	4	98.7	4	66.4	6	77.6	6	82.0	3	85.8	68	109.7	7	109.7	75	78.7		
6,000----	4	100.4	4	67.5	6	78.9	6	83.3	3	87.3	68	97.7	8	97.7	76	78.9		

¹ Maximum manpower allocated on an operation is 110 percent of established production rate (fig. 2, p. 4, for schematic sketch of line, and p. 3, for description).

³ Excludes Federal inspectors.

⁴ 36.8 birds man/min. on eviscerating line (2 workers); 33.0 birds/man-min. on defeathering line (3 workers).

² Established rate in birds per minute per worker (see Appendix).

TABLE 8.—*Double-eviscerating line with 6 Federal inspectors (type D): Manpower requirements and percentage of utilization of line workers and Federal inspectors at various rates*¹

Pro- duction per hour (birds)	Transfer birds (34.4) ²		Remove oil glands (33.0) ⁴		Open birds (38.8) ²		Draw vents (15.6) ²		Draw viscera (13.7) ²		Federal inspec- tion (18.5) ²		Trim- mers		Trim hearts and livers (14.2) ²		Remove and trim gizzards (11.7) ²	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
5, 100----	4	61.8	3	85.8	2	109.5	6	90.8	6	103.4	6	76.6	6	99.8	6	90.8	8	90.8
5, 200----	4	63.0	3	87.5	4	55.8	6	92.6	6	105.4	6	78.1	6	101.7	6	92.6	8	92.6
5, 300----	4	64.2	3	89.2	4	56.9	6	94.4	6	107.5	6	79.5	6	103.7	6	94.4	8	94.4
5, 400----	4	65.4	3	90.9	4	57.9	6	96.2	6	109.5	6	81.1	6	105.6	6	96.2	8	96.2
5, 500----	4	66.6	3	92.6	4	59.1	6	97.9	6	83.6	6	82.6	6	107.6	6	97.9	8	97.9
5, 600----	4	67.8	3	94.2	4	60.2	6	99.7	8	85.1	6	84.1	6	109.3	6	99.6	8	99.6
5, 700----	4	69.0	3	93.9	4	61.3	6	101.5	8	86.6	6	85.6	6	83.6	6	101.4	8	101.4
5, 800----	4	70.3	3	97.6	4	62.3	6	103.3	8	88.1	6	87.1	6	85.1	6	103.2	8	103.2
5, 900----	4	71.6	3	99.3	4	63.4	6	105.1	8	89.7	6	88.6	6	86.5	6	105.0	8	105.0
6, 000----	4	72.8	3	101.0	4	64.5	6	106.8	8	91.2	6	90.0	6	88.0	6	106.7	8	106.7
6, 100----	4	73.9	3	102.7	4	65.5	6	108.7	8	92.8	6	91.6	6	89.5	6	108.6	8	108.6
6, 200----	4	75.1	3	104.3	4	66.6	8	82.8	8	94.2	6	93.1	6	90.9	6	88.3	10	88.3
6, 300----	4	76.3	3	106.0	4	67.7	8	84.1	8	95.8	6	94.6	6	92.4	6	89.7	10	89.7
6, 400----	4	77.5	3	107.7	4	68.8	8	85.4	8	97.3	6	96.1	6	93.8	6	91.2	10	91.2
6, 500----	4	78.7	3	109.4	4	69.8	8	87.1	8	98.8	6	97.6	6	95.7	6	92.6	10	92.6
6, 600----	4	79.9	4	74.7	4	70.9	8	88.1	8	100.4	6	99.1	6	96.8	6	94.0	10	94.0
6, 700----	4	81.2	4	75.9	4	72.0	8	89.5	8	101.9	6	100.6	6	93.3	6	95.5	10	95.5
6, 800----	4	82.3	4	77.0	4	73.0	8	90.8	8	103.4	6	102.1	6	99.7	6	96.8	10	96.8
6, 900----	4	83.6	4	78.1	4	74.1	8	92.1	8	104.9	6	103.6	6	101.1	6	98.3	10	98.3
7, 000----	4	84.8	4	79.3	4	75.2	8	93.5	8	106.5	6	105.1	6	102.5	6	99.7	10	99.7
7, 100----	4	86.0	4	80.4	4	76.2	8	94.8	8	107.9	6	106.6	6	104.1	6	101.1	10	101.1
7, 200----	4	87.2	4	81.5	4	77.3	8	96.2	8	109.5	6	108.1	6	105.6	6	102.6	10	102.6

See footnotes at end of table.

TABLE 8—*Double-eviscerating line with 6 Federal inspectors (type D): Manpower requirements and percentage of utilization of line workers and Federal inspectors at various rates*¹—Continued

Produc- tion per hour (birds)	Remove lungs (24.9) ²		Snip neck vertebras (37.0) ²		Remove crops and windpipes (21.1) ²		House inspection (20.0) ²		Peel gizzards (38.2) ²		Total workers, excluding wrapping and stuffing giblets ³		Wrap and stuff giblets (12.8) ²		All work- ers ³	Birds per man- hour
	Work- ers	Man- power utiliza- tion	Work- ers	Man- power utiliza- tion	Work- ers	Man- power utiliza- tion	Work- ers	Man- power utiliza- tion	Work- ers	Man- power utiliza- tion	Number	Percent	Work- ers	Man- power utiliza- tion		
5,100----	4	85.3	4	57.4	4	100.7	4	106.2	3	74.2	60	85.0	7	94.5	67	76.1
5,200----	4	87.0	4	58.6	4	102.7	4	108.2	3	75.6	62	83.9	7	96.9	69	75.4
5,300----	4	88.7	4	59.7	4	104.7	6	73.6	3	77.1	64	82.8	7	98.4	71	74.6
5,400----	4	90.4	4	60.8	4	106.6	6	75.0	3	78.5	64	84.4	7	100.0	71	76.1
5,500----	4	92.0	4	61.9	4	108.6	6	76.5	3	79.9	66	83.3	7	102.3	73	75.3
5,600----	4	93.7	4	63.0	6	73.7	6	77.8	3	81.5	68	82.3	7	103.9	75	74.7
5,700----	4	95.3	4	64.2	6	75.0	6	79.1	3	82.9	70	81.4	7	106.3	77	74.0
5,800----	4	97.0	4	65.3	6	76.3	6	80.5	3	84.4	70	82.9	7	107.8	77	75.3
5,900----	4	98.7	4	66.4	6	77.7	6	81.9	3	85.8	70	84.3	7	109.4	77	76.6
6,000----	4	100.3	4	67.5	6	79.0	6	83.3	3	87.3	70	85.7	8	97.7	78	76.9
6,100----	4	103.1	4	68.7	6	80.3	6	84.8	3	88.7	70	87.1	8	99.2	78	78.2
6,200----	4	103.7	4	69.8	6	81.6	6	86.1	3	90.1	74	83.8	8	100.8	82	75.6
6,300----	4	105.4	4	70.9	6	82.9	6	87.5	3	91.6	74	85.1	8	102.3	82	76.8
6,400----	4	107.1	4	72.1	6	84.3	6	88.9	3	93.1	74	86.5	8	103.9	82	78.0
6,500----	4	108.7	4	73.2	6	85.9	6	90.6	3	94.5	74	87.8	8	105.8	82	79.3
6,600----	6	73.6	4	74.3	6	86.9	6	91.7	3	96.0	77	85.7	8	107.4	85	77.6
6,700----	6	74.8	4	75.5	6	88.2	6	93.1	3	97.5	77	87.0	8	109.1	85	78.8
6,800----	6	75.9	4	76.6	6	89.5	6	94.4	3	98.9	77	88.3	9	98.4	86	79.1
6,900----	6	77.0	4	77.7	6	90.8	6	95.8	3	100.3	77	89.6	9	99.8	86	80.2
7,000----	6	78.1	4	78.8	6	92.2	6	97.2	3	101.8	77	90.9	9	101.3	86	81.4
7,100----	6	79.2	4	79.9	6	93.4	6	98.6	3	103.2	77	92.2	9	103.2	86	82.6
7,200----	6	80.3	4	81.1	6	94.8	6	100.0	3	104.7	77	93.5	9	104.7	86	83.7

¹ Maximum manpower allocated to an operation is 110 percent of established production rate (see fig. 2, p. 4, for schematic sketch of line, and p. 3, for description).

² Established rate in birds per minute per worker (see Appendix).

³ Excludes Federal inspectors.

⁴ Oil glands removed while birds are on defeathering line.

Figure 6 compares production per man-hour of the four major eviscerating line types discussed in this report. Points where Federal inspectors are working at a normal (100 percent) pace are indicated for each type of line.

The curve for line "A" in figure 6 shows the productivity of a one-inspector line. Two points are shown for inspector norms—one for 6-inch bird spacing and one for 12-inch bird spacing. The birds eviscerated per man-hour continues to increase as hourly production increases to the terminal point where the inspector is working at 110 percent of normal.⁶

The best labor utilization obtained in these examples occurs with the regular four-inspector arrangement (line C) with two peaks above the 80 birds per minute level (4,500 and 4,800 birds per hour) and with the six-inspector line (type D) at 6,500 birds per hour and above 6,800.

At certain production levels none of the types of conveyor lines discussed in this report are very efficient. For instance, production ranges between 1,500 and 2,200 birds per hour and between 3,000 and 4,000 birds per hour do not offer effective labor utilization. At such low levels of productivity the use of a combination of line types should be considered.

CONCLUSION

To obtain optimum utilization of Federal inspectors, care must be taken to insure that the best type of equipment and arrangement are provided for a particular production level.

Although inspectors can visually examine carcasses in the shortest possible time when birds are spaced 12 inches apart, this spacing becomes impractical beyond the production level for one inspector per line or side since the increase in line speed required to supply two inspectors side by side examining alternate birds is too great. For production ranges above 3,000 birds per hour, birds must be spaced on 6-inch centers, at a sacrifice in inspector productivity. As production exceeds 3,000, there are specific types of equipment and rates of line speed at which worker and inspector productivities are at a maximum.

⁶ All lines charts are carried to approximately 110 percent of the normal rate established for Federal inspectors to indicate the trend of overall eviscerating labor to that point.

Similarly, certain production levels should be avoided when designing a plant or increasing production capacity if worker and inspector capabilities are to be fully utilized. Production per man-hour for both worker and inspector is below 100 percent normal effort when production ranges between 1,500 and 2,200 birds per hour. The same situation prevails at production rates between 3,000 and 4,000 birds per hour, regardless of the combination of line types. The range between 5,000 and 6,200 birds per hour should also be avoided if available worker and inspector capacities are to be fully used.

Regardless of the type of equipment, lower productivity per inspector results when inspection is disturbed by equipment malfunction, poor bird presentation at inspection points, or poor workmanship by the eviscerating crew. The productivity of the inspector can be fully utilized by using only properly trained trimmers who can relieve the inspector of many noninspection operations.

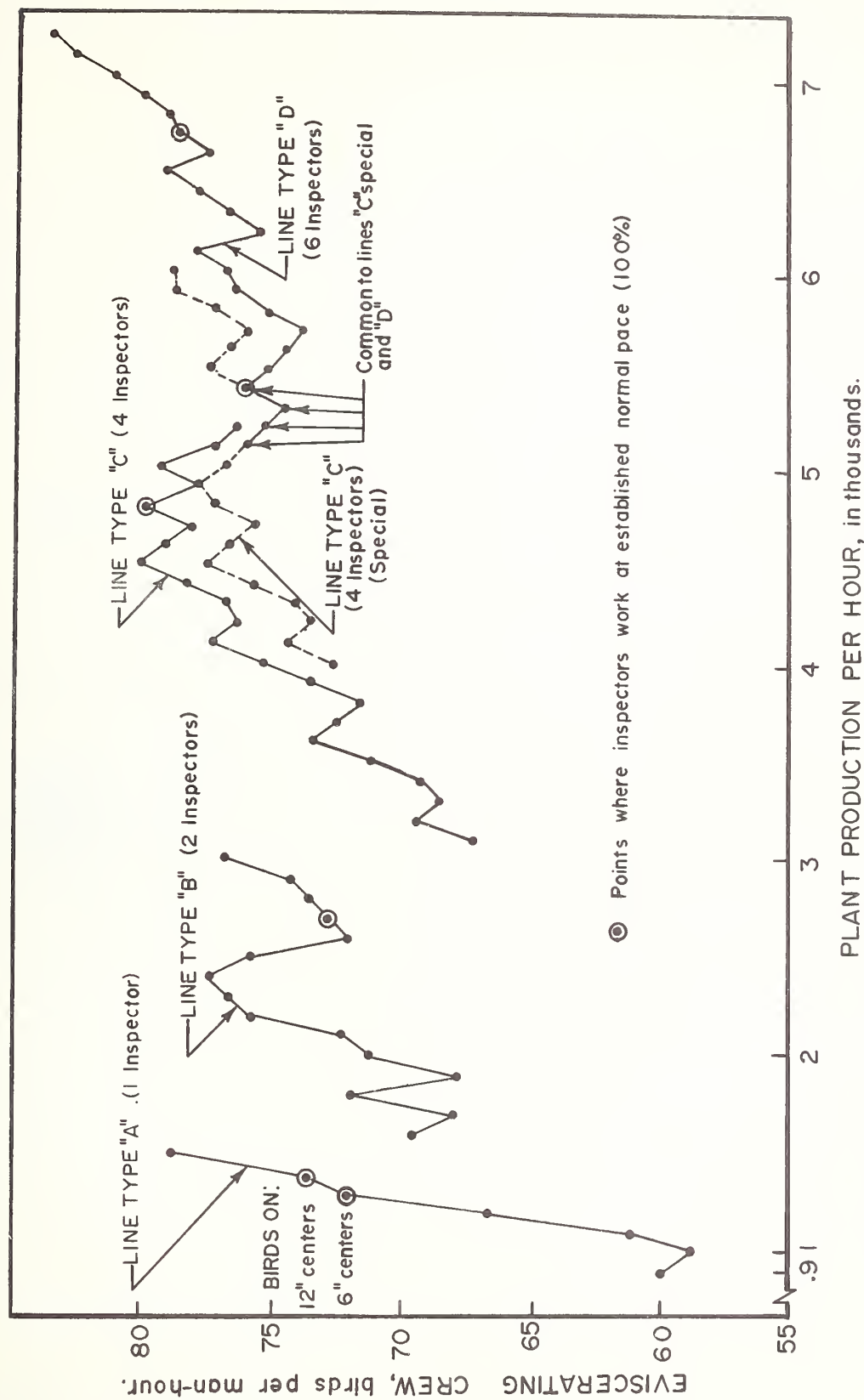


FIGURE 6.—Production per man-hour at various production rates for four major line types involving one, two, four, and six inspectors.

APPENDIX

Standard Data

Rates per worker for performing chicken-eviscerating operations and inspection rates per inspector for various line types and bird spacings:

	<i>Birds/man-min.</i>
Transfer birds	34.4
Remove oil glands:	
On viscerating line.....	36.8
On defeathering line.....	33.0
Open birds	38.8
Draw vent	15.6
Draw viscera	13.7
Federal inspection:	
Line-type A:	
6-inch centers.....	21.3
12-inch centers.....	22.7
Line-type B	22.7
Line-type C	20.2
Line-type D	18.5
Remove hearts and livers.....	14.2
Remove and clean gizzards.....	11.7
Snip neck vertebrae.....	37.0
Remove lungs	24.9
Remove crops and windpipes.....	21.1
House inspection	20.0
Peel gizzards	38.2
Wrap and stuff giblets.....	12.8

